

TWIN CITIES METRO AREA CHLORIDE PROJECT

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MISSISSIPPI RIVER FORUM
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Minnesota Pollution
Control Agency

Chloride & Water Quality





Water Quality Concerns



- Chloride is toxic to aquatic life
 - 230mg/L Chronic, 860 mg/L Acute
- Chloride is a permanent pollutant, once in our surface waters there is no feasible way to remove it
- University of Minnesota study found that 78% of the chloride used is being retained in the TCMA
- At high concentrations can disrupt lakes natural mixing process
- Costly to treat contaminated groundwater for drinking purposes
- Removal of chloride in wastewater effluent is cost-prohibitive for most publically owned facilities

Water Quality Conditions



- 37 lakes, streams & wetlands on DRAFT 303(d) list for chloride in the TCMA (roughly 10% assessed) – 2 Chloride TMDLs completed
- 41 waters determined to be “High Risk” in TCMA
 - *Defined as having values within 10% of the standard or at least one exceedance of the standard*
- Groundwater levels of chloride in the TCMA are increasing
 - 30% of wells above the standard
 - *Impact on baseflow levels of chloride is important*
- USGS groundwater data also shows Significant increase in chloride since 1996 in Upper Mississippi River Basin
- Metropolitan trend analysis for the Mississippi, Minnesota and St. Croix Rivers in TCMA all show increases in chloride
(compared to the 10 year average)

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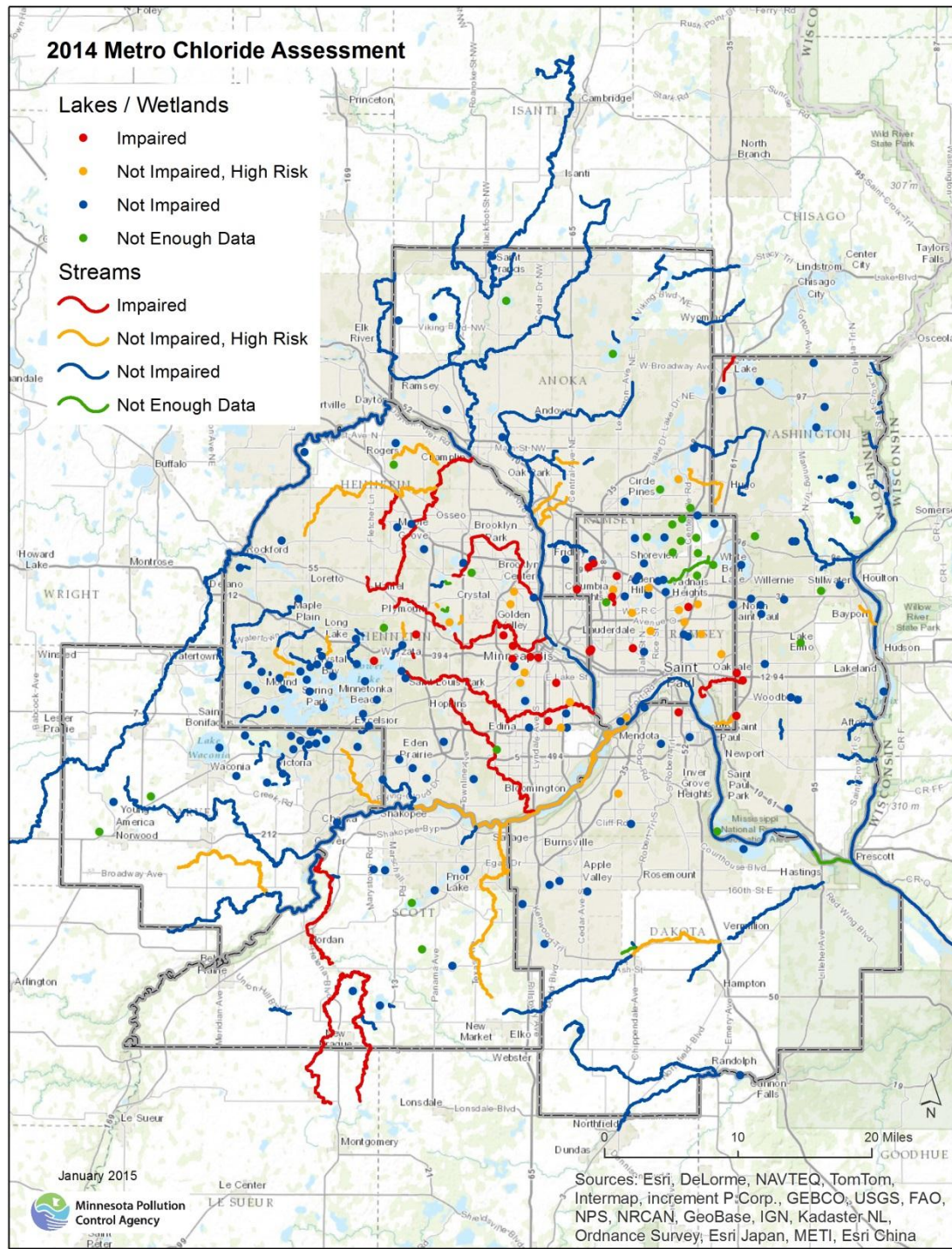
2014 Metro Chloride Assessment

Lakes / Wetlands

- Impaired
- Not Impaired, High Risk
- Not Impaired
- Not Enough Data

Streams

- Impaired
- Not Impaired, High Risk
- Not Impaired
- Not Enough Data

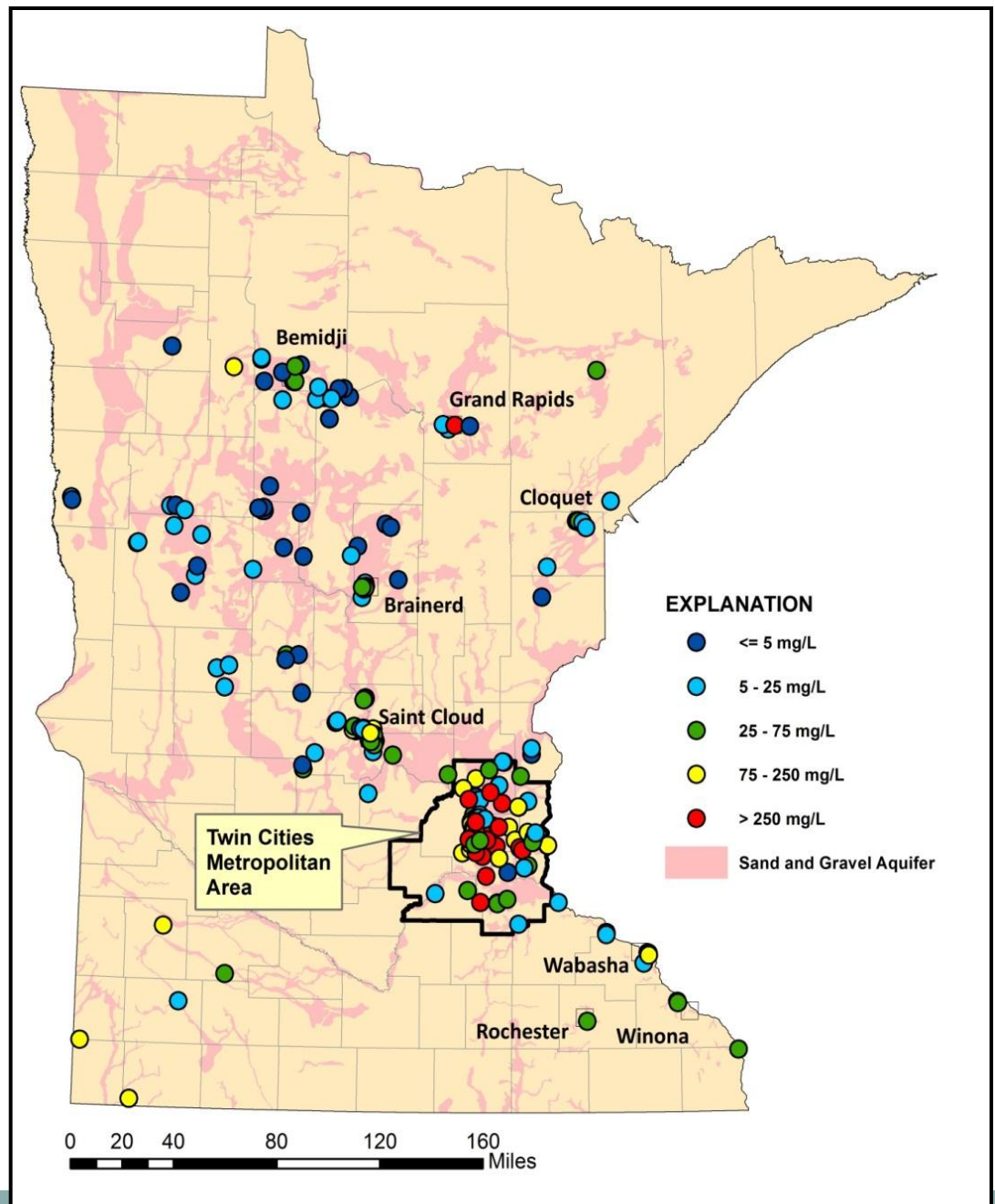


Map

Chloride Concentrations in Minnesota's Sand and Gravel Aquifers

Average chloride concentrations in groundwater based on land use

Land Use	Chloride (mg/L)
Residential	45 mg/L
Commercial/Industrial	60 mg/L
Undeveloped	15 mg/L



Public Safety Concerns:

Road Salt



- 365,000* tons of road salt are applied in TCMA each year

**this is an estimate based on purchasing records*



- We need safe roads, parking lots and sidewalks in winter months
- Currently no alternative de-icer without negative impacts to the environment
- Applied at all levels; State, County, City, Businesses/Schools/Churches and Homeowners
- Private applicators up against fear of slip & fall lawsuits – default is to apply more product
- Public expectations are difficult to meet

Public Concerns:

Water Softening



- The public desires soft water (minimal hardness levels)
- Individual water softeners are used in many households without much thought given to amount of salt used
- Treatment to remove chloride from wastewater effluent is costly



TCMA Chloride Project



TCMA Chloride Management Plan



- Develop Chloride Management Plan for the 7-county metro (*project began 2010, draft plan Oct. 2014*):
 - Create shared vision & develop partnerships
 - Evaluate existing water quality conditions
 - Identify sources of chloride in TCMA
 - Set realistic goals to protect all surface waters
 - Complete Chloride TMDLs for all impaired waters
 - Layout flexible implementation strategies that will help achieve water quality goals
 - Provide resources to assist with implementation and tracking progress

Inter-Agency Advisory Team

MPCA, MnDOT, Met Council,
BWSR, DNR, USGS, Dept. of
Health, U of M

Monitoring Sub-Group

MPCA, DNR, Met
Council, USGS, local
partners

Implementation Plan Committee

Winter Maintenance
Professionals, Cities,
Counties, MnDOT,
WMOs/WDs

MPCA project team

Technical Advisory Committee

WMOs, WDs, Cities,
Counties, MnDOT

Outreach Group

WMOs, WDs, MS4s, road salt
applicators, Citizens

Technical Expert Group

Hands-on road salt
applicators and
suppliers

Education & Outreach Committee

MPCA, MnDOT &
local education
specialists

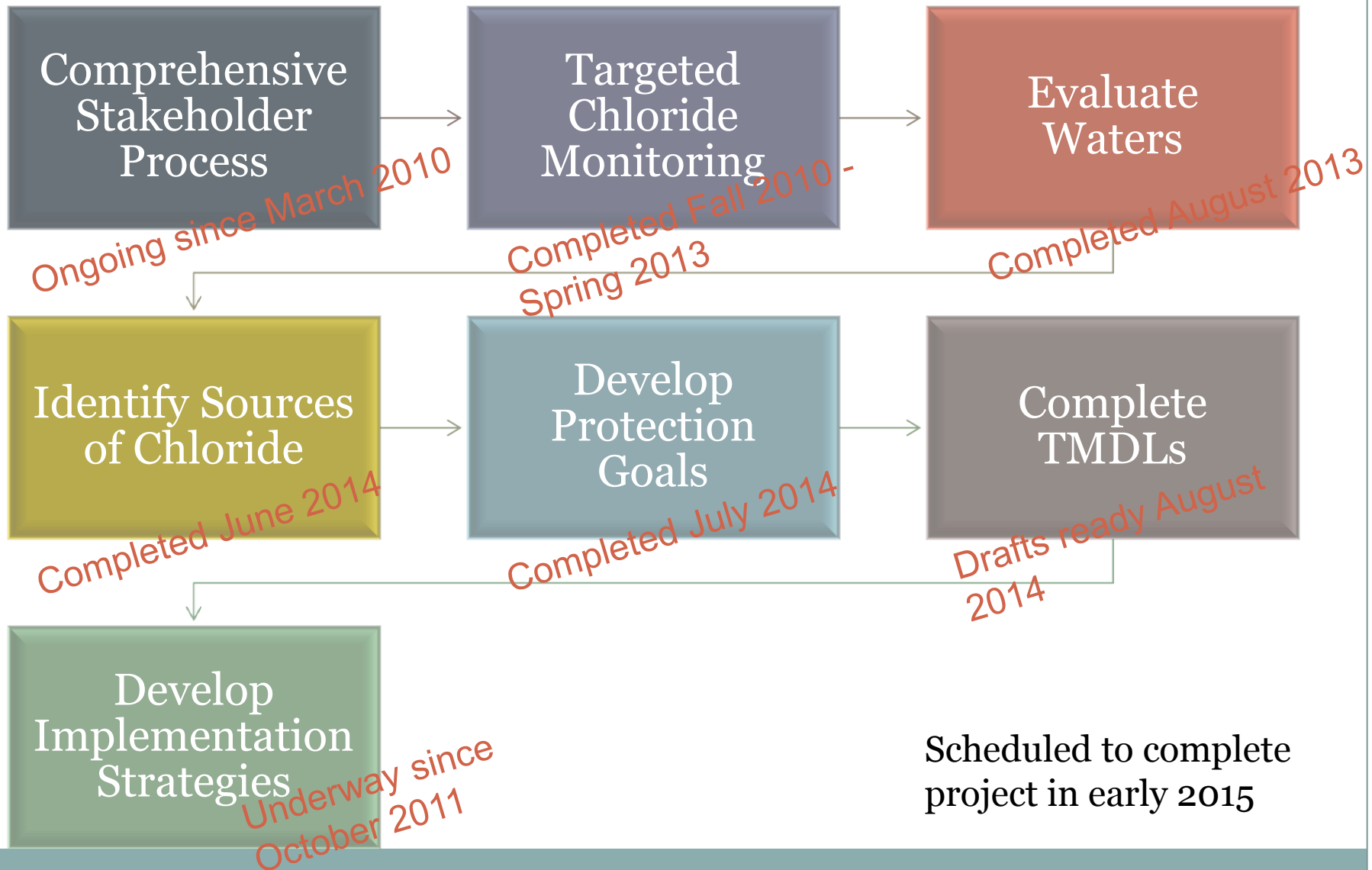
Outreach & General Communications

- MPCA Road Salt & Water Quality Website
- October 2011 - Poster at WRC
- August 2012 - Salt Dilemma Display created
- Jan. 2013 - EPA's Stormwater Pollution Prevention Webinar Series: Road Salt Pollution Prevention Strategies
- Numerous press releases and media interviews since 2010
- Road Salt Symposium annually since 2010



TCMA Chloride Project: Timeline

Began process in 2010



TCMA Chloride Management Plan



Chloride Management Plan

Purpose - Scope - Audience

Purpose

- Inform an understanding on the impacts of chloride on TCMA water quality
- Develop an appreciation of the competing demands of level of service and reduced salt usage
- Set performance-based goals for restoration and protection
- Inform and guide implementation of improved winter maintenance practices and policy needs
- Demonstrate the success and economic benefits of improved practices

Scope

- Status and trends of chloride levels in lakes, wetlands, streams, and groundwater
- Sources of chloride
- Restoration and protection goals
- Implementation strategies to reduce chloride impacts
- Educational and training resources
- Continued monitoring, tracking and adaptive management

Audience

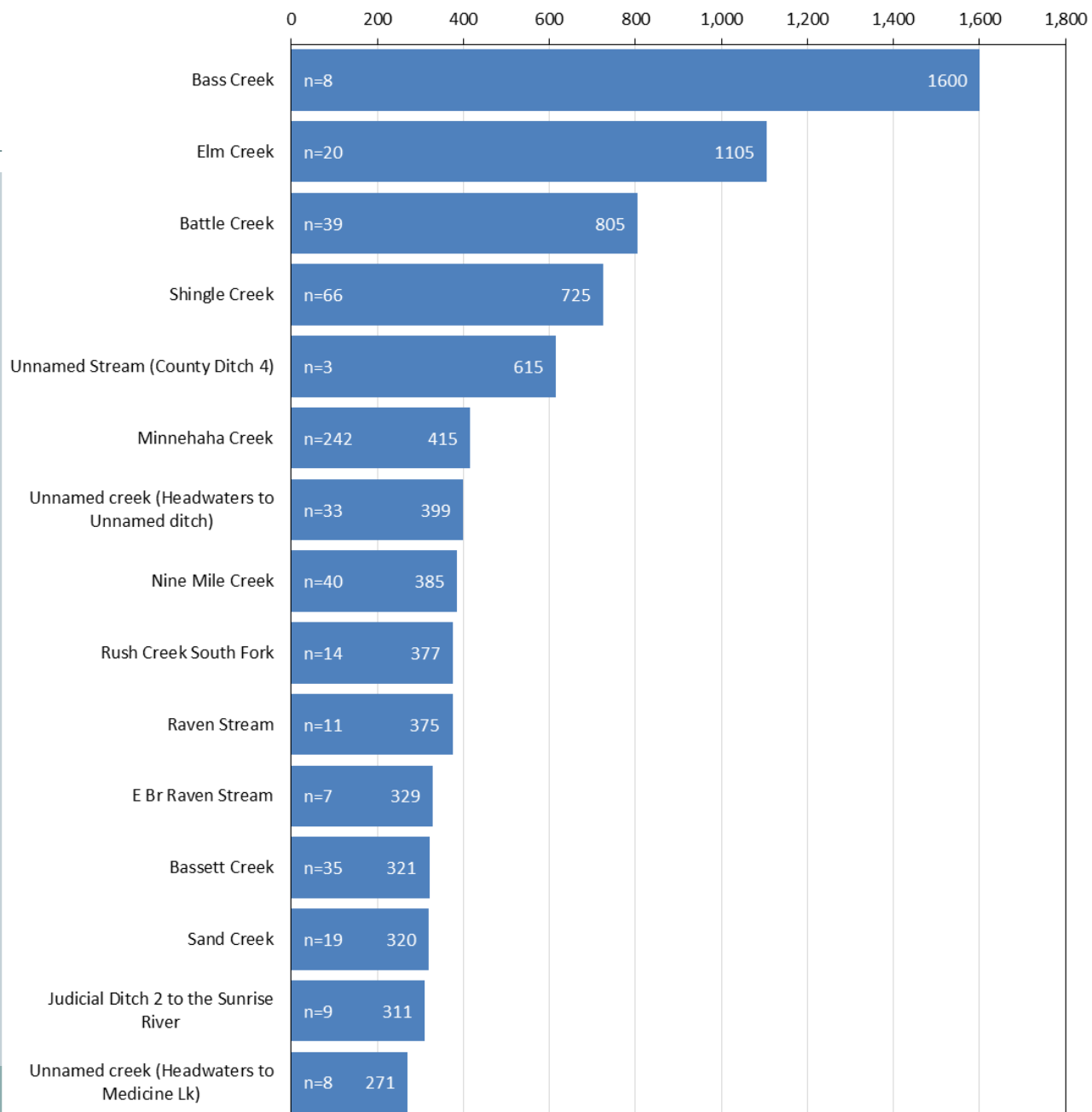
- Local working groups (local governments, watershed management groups, etc.)
- Winter maintenance groups (MnDOT, local governments, private applicators, commercial property owners, residents, etc.)
- Elected officials and policy-makers
- State agencies (MPCA, MnDOT, DNR, BWSR, etc.)

Chloride Water Quality Trends

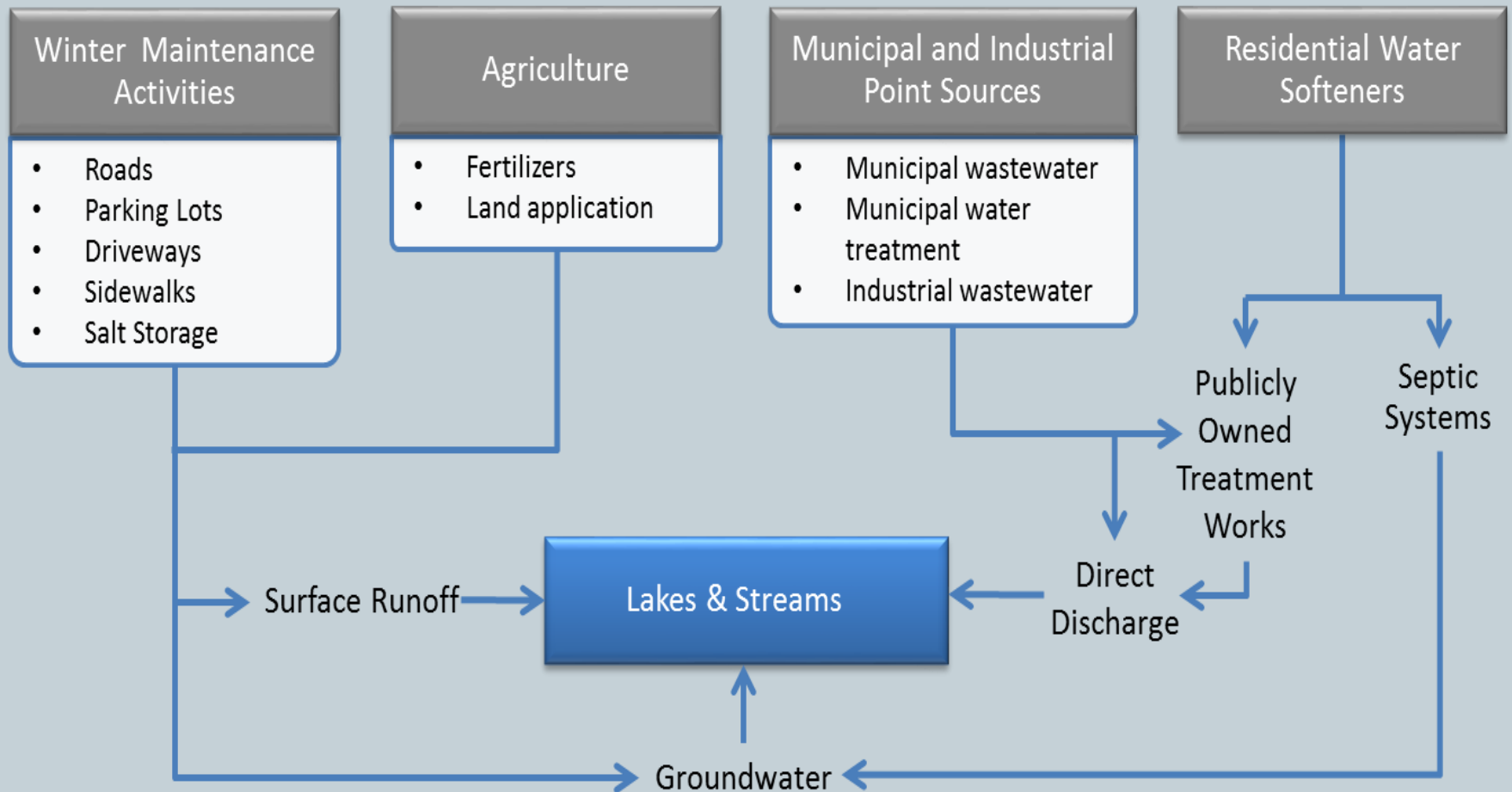


- Long-term chloride trends
- Chloride relationship to winter severity
- Seasonal chloride trends
- Chloride trends within lakes
- Chloride relationships to watershed characteristics
- Chloride concentrations in stormwater
- Chloride relationships between surface and groundwater
 - This information is intended to help inform management decisions such as where and when to focus monitoring efforts and where to prioritize implementation activities.

Average chloride concentration when exceeding 230 mg/L



Sources



TMDL Summary

Lake	WBID	Watershed Area (ac)	TMDL and Components (all values in lbs/yr of chloride)					
			TMDL	WLA		LA		Margin of Safety
				MS4 Categorical	Wastewater	Non-Permitted	Natural Background	
Battle Creek Lake	82-0091-00	4,326	2,153,698	1,766,033			172,296	215,370
Brownie Lake	27-0038-00	391	263,812	216,326			21,105	26,381
Carver Lake	82-0166-00	2,242	1,071,124	878,321			85,690	107,112
Como	62-0055-00	1,850	994,078	815,144			79,526	99,408
Diamond Lake (wetland)	27-0022-00	744	486,017	398,534			38,881	48,602
Kasota Ponds North (wetland)	62-0280-00	3,070	2,250,690	1,845,566			180,055	225,069
Kasota Ponds South (wetland)	62-0281-00	3,070	2,250,690	1,845,566			180,055	225,069
Kohlman Lake	62-0006-00	7,533	4,839,183	3,106,733	1,050,484		303,096	378,870
Little Johanna Lake	62-0058-00	1,703	1,224,243	1,003,879			97,939	122,424
Long Lake (South)	62-0067-02	114,785	26,334,624	21,534,261	4,030	56,826	2,106,448	2,633,059
Loring Pond (South Bay)	27-0655-02	34	9,764	8,007			781	976
Mallard Marsh (wetland)	62-0259-00	3,070	2,250,690	1,845,566			180,055	225,069
Parkers Lake	27-0107-00	1,064	1,431,262	528,161	787,163		51,528	64,410
Peavey Lake	27-0138-00	776	205,995	165,889	3,692		16,184	20,230
Pike Lake	62-0069-00	5,735	3,591,268	2,943,971	1,059		287,217	359,021
Powderhorn Lake	27-0014-00	332	218,587	179,242			17,487	21,859
Silver Lake	62-0083-00	655	370,011	303,409			29,601	37,001
Spring Lake	27-0654-00	76	44,264	36,296			3,541	4,426
Sweeney Lake	27-0035-01	2,439	1,456,271	1,194,142			116,502	145,627
Tanners Lake	82-0115-00	1,732	826,520	677,746			66,122	82,652
Thompson Lake	19-0048-00	178	134,340	110,159			10,747	13,434
Valentine Lake	62-0071-00	2,404	1,165,072	955,359			93,206	116,507
Wirth	27-0037-00	426	1,095,000	897,900			87,600	109,500

Protection & Restoration Strategy

- Same BMPs for protection as for impaired waters
- Reduce chloride at the sources
- Goal is to get all winter maintenance programs performing at a level that is using minimal amount of salt
- Set water quality goals for point sources to work towards meeting
- Allow flexibility in implementation



TCMA CMP Performance Based Implementation						
Audience	years 1-2		years 3-5	years 6-10	Beyond year 10	
Winter Maintenance Leadership (state, county, city, schools, private) Those not involved in day to day operations of maintenance crew.	-	Become educated	-	Follow you plan	-	Re-assess your operations
	-	Review responsibilities	-	Share your successes	-	Re-assess your operations
	-	Develop policies			-	Revise goals
	-	Assess the situation			-	Continue to implement changes
	-	Create goals			-	Continue to implement changes
	-	Set priorities			-	Share your successes.
	-	Implement changes				
Winter Maintenance Professionals (state, county, city, schools, private) Plow drivers, mechanics, supervisors of crew.	-	Become educated	-	Follow your plan	-	Re-assess your operations
	-	Attend training	-	Eliminate poor practices	-	Re-assess your operations
	-	Keep an open mind towards change	-	Share your successes	-	Adjust your goals
	-	Look for ways to make salt use more efficient			-	Follow your plan
	-	Use WMAAt tool			-	Eliminate all poor practices
	-	List with your desired changes			-	Share your successes
	-	Prioritize your action plan				
	-	Implement changes				
WMOs/WDs, Environmental Organizations and Institutions, and Educators	-	Modify plan	-	Implement plan	-	Review and revise your outreach plan
	-	Become educated	-	Educate	-	Educate
	-	Put salt education and outreach goals in your operating plans				Continue to educate
	-	Develop/modify grant program				Encourage testing of new technologies
	-	Develop a cost share program				
	-	If you already have a grant program, modify				
Citizens	-	Become educated	-	Reduce salt use	-	Continue to reduce salt use.
	-	Follow advice	-	Encourage others to reduce salt use	-	Encourage others to reduce salt use.
	-	Encourage others to use less salt				
Policy Makers (city, county, state, other)	-	Read the TCMA management plan	-	Improve policy	-	Improve policy
	-	Become educated				
	-	Understand why we use salt				
	-	Understand what the options are for lower salt use				

Example Activities - WMOs/WDs, Environmental Organizations and Institutions, and Educators



EXAMPLE: YEARS 1-2

- ☐ Put salt education and outreach goals in your organizations operating plans.
- ☐ Partner with MPCA to offer the “Smart Salting” winter maintenance training for local private and public winter maintenance professionals each winter.
- ☐ Educate 50% of constituents on the benefits of smart salt use.
- ☐ Create awareness about the environmental impacts of chloride through education, outreach, and other activities to local residents, applicators, elected officials and businesses.
- ☐ Monitor local surface waters for chloride concentrations to track trends, track progress and understand the movement of chloride through the watershed.
- ☐ Develop incentive based program for chloride reduction strategies.
- ☐ Host yearly workshops for local winter maintenance professionals to encourage the use of the WMA_t and track progress of BMPs implemented.
- ☐ Provide a measuring cup type salt scooper to homeowners and small businesses in order to raise awareness of the amount of salt they are using.

Example Activities – Policy Makers

EXAMPLE: YEARS 1-2

- Read the TCMA chloride management plan.
- Become educated on the salt problem and ways your constituents contribute to it.
- Understand options for reducing chloride use.
- Develop a limited liability law to protect private contractors from being sued if they are following BMPS, similar to New Hampshire. Fear of law suits often drives over application of salt.

EXAMPLE: YEARS 3-5

- ☐ Require attendance once every 5 years at MPCA Smart Salting winter maintenance training to apply salt for hire in your city.
- ☐ Those that apply salt should be educated and certified to state standards similar to the Department of Agriculture's pesticide applicator certification program.
- ☐ Require all new construction to have irrigation water and drinking water plumbed so as to not pass through the water softener
- ☐ Require water softeners that recharge by the time of day and not by the salinity of water be banned from sale.
- ☐ Ordinance for city's where the water is softened by the city that personal water softeners are not allowed.

Chloride Reduction Strategies: Winter Maintenance Practices

- Shift from granular to liquids
- Improved physical snow removal
- Snow and ice pavement bond prevention
- Training for maintenance professionals
- Education for the public and elected officials
- Use Winter Maintenance Assessment tool



Case Studies

University of Minnesota, Twin Cities

- Made changes to winter maintenance program 2006

Material	Use (tons/yr)	Use (tons/yr)	Reduction
Rock Salt	775	462	40%
	(1997-2005)	(2006-2008)	
ICE MELT	131	64	51%
(MgCl ₂)	(1997-2005)	(2006-2008)	
ICE MELT	131	59	55%
(MgCl ₂ - CaCl ₂)	(1997-2005)	(2008-2014)	
Sand	1965	20	99%
	(1997-2005)	(2006-2014)	

- purchased new equipment for ~ \$10,000
- saved \$55,000 the first year the BMPs were implemented

City of Waconia

- 2010 updated “Snow and Ice Policy” to a “Winter Maintenance Policy” – proactive focus opposed to reactive
- Addition of ordinances reflective of policy guidelines
- Calibration and equipment changes resulted in 70% reduction in rates
- Addition of pre-wet practices and material savings results in yearly \$8,600 cost savings

Winter Maintenance Assessment Tool WMA_t





Vision



To develop a planning tool that will help winter maintenance organizations:

- Document their current practices
- Chart a path towards salt reduction
- Develop a strategy unique to their operation
- It looks at small areas of winter maintenance
- Provides insight into current operations
- Shows user recommended practices (learning tool)
- Allows a flexible approach for implementation

Stakeholder Process: 2011-2014



- Road Salt Symposium survey
- Literature Searches
- Phone calls, phone interviews with members of the advisory team and industry experts
- Email correspondence with members of the advisory team and industry experts
- The implementation plan committee input
- Test of questions on industry pro's

The technical expert team was formed that reflects maintenance leaders in Minnesota. These leaders represent winter maintenance of high speed roads, low speed roads, parking lots, sidewalks, deicer sales and equipment. The members are:

- Tom Broadbent - EnviroTech Services
- Bob Vasek-MnDOT
- Mike Greten -Dakota County
- Mike Scherber-Hennepin County
- Craig Eldred -City of Waconia
- Ryan Foudray - Prescription Landscape
- Joe Wiita-Scott County
- Brian Brown-Three Rivers Park District
- Kevin Nelson-City of St. Paul
- Mike Kennedy-City of Minneapolis
- Matt Morriem-City of St. Paul
- Jeff Warner-Force America
- Mark Fischbach-MnDOT



Thank You

Provide information for your new assessment:

Assessment Location:

Cityville

Assessment Description:

Assessment #1

Assessment Type(s):

- ☒ Best management practices (BMPs)
- ☒ Salt savings calculations

Time Period(s) to Assess:

- ☐ 'Past' winter season: 2004-05 ▼
- ☒ 'Current' winter season: 2013-14 ▼
- ☒ 'Future' winter season: 2018-19 ▼

Surface Type(s) to Evaluate:

- ☒ High Speed Roads
- ☒ Low Speed Roads
- ☒ Parking Lots
- ☒ Sidewalks / trails

Notes:

This assessment will evaluate improvements to salt management through the future adoption of "best management practices", and also estimate the salt savings resulting from those improved practices.

Create Assessment

Completing an Assessment



Minnesota Pollution Control Agency

WMA Assessment: Cityville (2013-14)

Link to User's
Home Page

Report Link

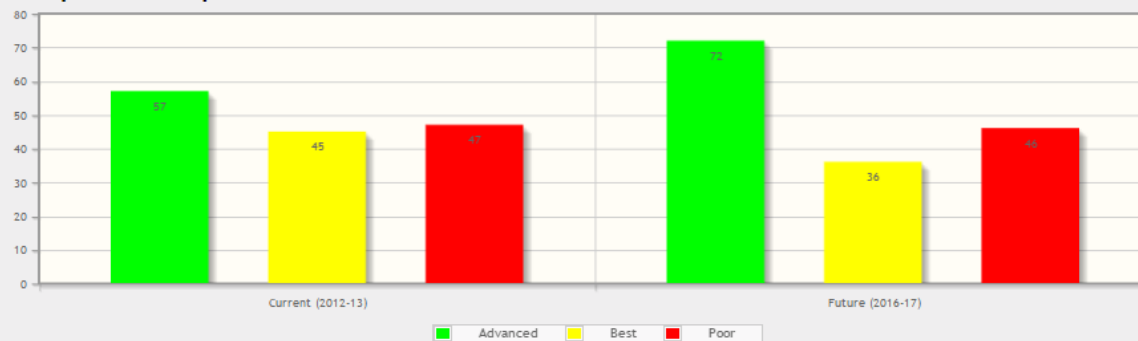
Questionnaire
Sections
(each section has
multiple questions)

Table of Contents	General Information
<p>General Links:</p> <ul style="list-style-type: none">• My Home Page• Assessment Report <p>Questionnaire Sections:</p> <ul style="list-style-type: none">• General Information:<ul style="list-style-type: none">◦ General Information (% complete)◦ Salt Usage/Storage Data (% complete)• Accuracy:<ul style="list-style-type: none">◦ Calibrate (% complete)◦ Application Rates (% complete)◦ Controllers (% complete)◦ Accounting (% complete)• Before the Storm:<ul style="list-style-type: none">◦ Anti-Icing (% complete)◦ Plow & Apply (% complete)◦ Call Outs (% complete)• Efficiency:<ul style="list-style-type: none">◦ Deicers (% complete)• Reduce Waste:<ul style="list-style-type: none">◦ Storage (% complete)◦ Hauling (% complete)◦ Loading (% complete)◦ Unloading (% complete)◦ Spread Pattern (% complete)◦ Freeze Up (% complete)◦ Cleaning (% complete)◦ Equipment (% complete)◦ Application Speed (% complete)◦ Application Frequency (% complete)• Before Winter:<ul style="list-style-type: none">◦ Policy Communication (% complete)◦ Policy Documentation (% complete)◦ Drainage (% complete)◦ Readiness (% complete)◦ Liquids (% complete)◦ Training (% complete)◦ Routes (% complete)◦ Regulations (% complete)◦ Surfaces (% complete)◦ Level of Service (% complete)• After Winter:<ul style="list-style-type: none">◦ Salt Recovery (% complete)	<p>Assessment Name: <input type="text" value="Cityville (2013-14)"/></p> <p>Assessment Location: <input type="text" value="Cityville"/></p> <p>Assessment Description: <input type="text" value="Assessment #1"/></p> <p>Assessment Type(s): <input checked="" type="checkbox"/> Best management practices (BMPs) <input checked="" type="checkbox"/> Salt savings calculations</p> <p>Time Period(s) to Assess: <input type="checkbox"/> 'Past' winter season (not selected) <input checked="" type="checkbox"/> Current (2013-14) <input checked="" type="checkbox"/> Future (2018-19)</p> <p>Surface Type(s) to Evaluate: <input checked="" type="checkbox"/> High Speed Roads <input checked="" type="checkbox"/> Low Speed Roads <input checked="" type="checkbox"/> Parking Lots <input checked="" type="checkbox"/> Sidewalks / trails</p> <p>Notes:</p> <div><p>This assessment will evaluate improvements to salt management through the future adoption of "best management practices", and also estimate the salt savings resulting from those improved practices.</p></div> <p>Date created: 9/24/2014 5:19 PM</p> <p>Date last revised: 9/24/2014 5:19 PM</p>

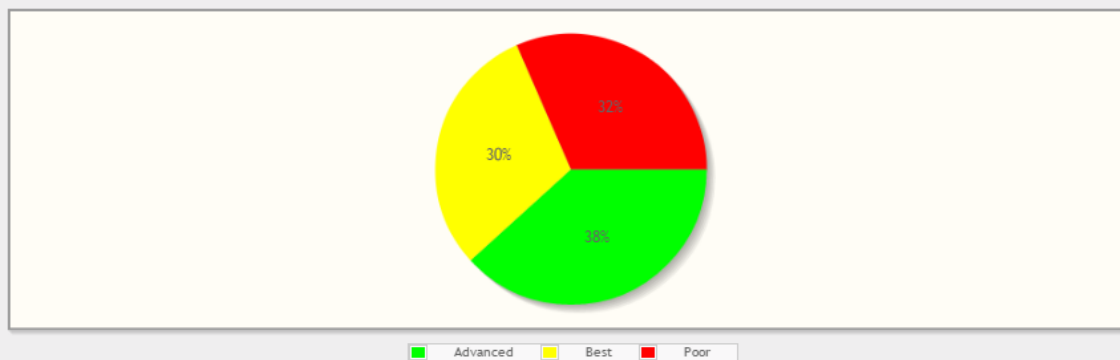


Winter Maintenance Assessment Tool (WMA_t)

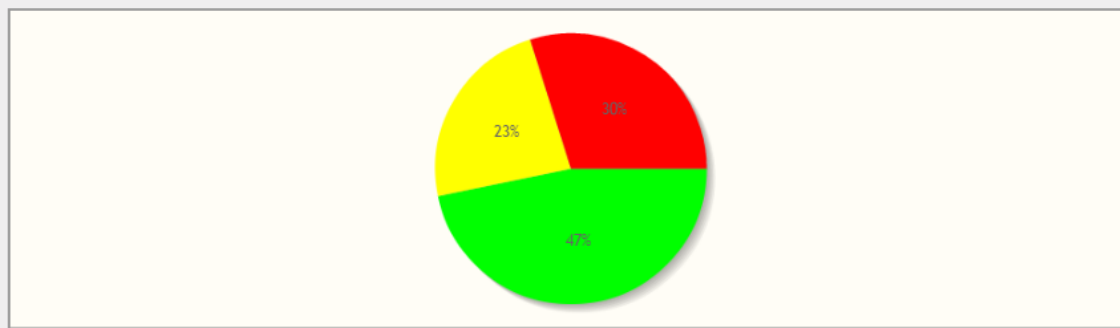
Comparison of Responses Between Assessment Periods



Responses for *Current (2012-13)* Assessment Period



Responses for *Future (2016-17)* Assessment Period

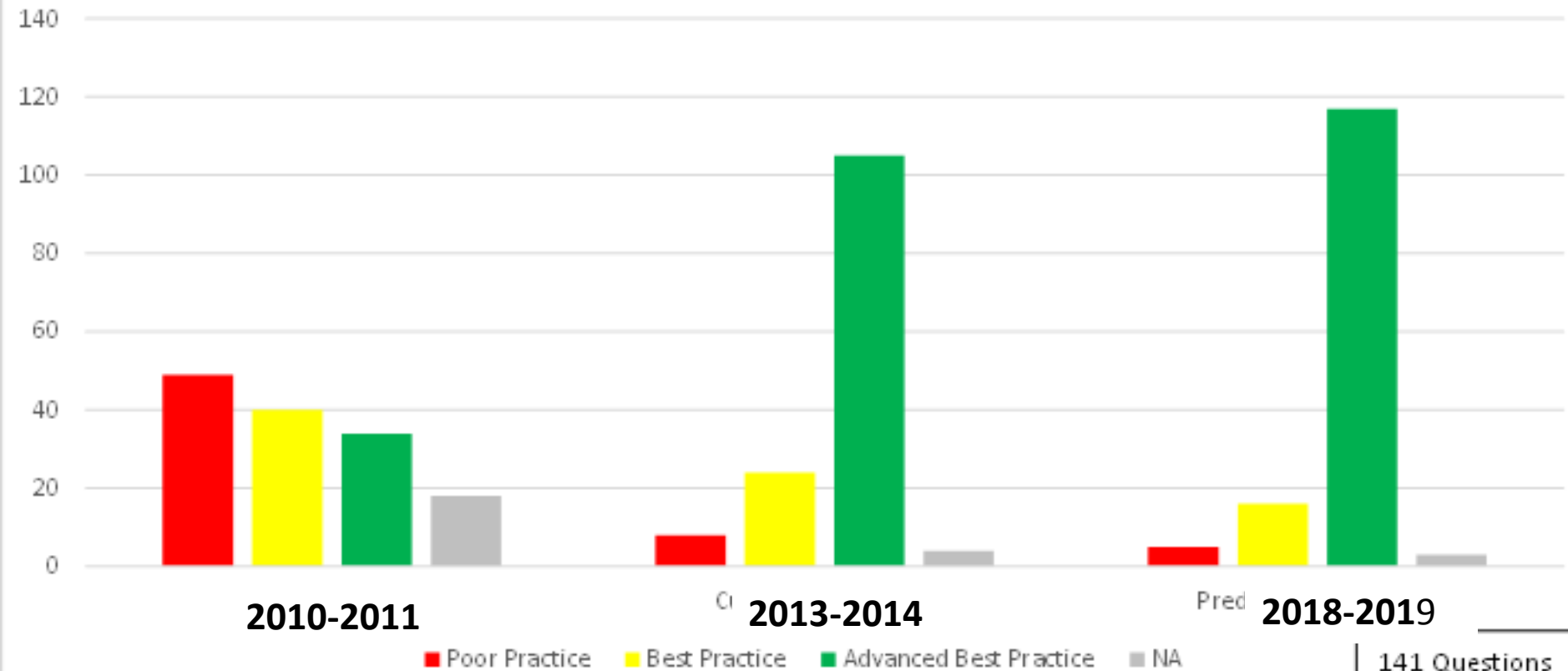


City #1

Draft



3 Seasons Comparison City 1



141 Questions



Winter Maintenance Assessment Tool (WMA_t): BMP Summary Report

To learn more about road salt and water quality in Minnesota, visit [MPCA's Road Salt and Water Quality Site](#).

Response Count Summary:

	Current (2012-13) assessment period	Future (2016-17) assessment period
Advanced Best Practices category:	57	72
Best Practices category:	45	36
Poor Practices category:	47	46
General category:	12	7

Improved Best Practices

[Comparing *Current (2012-13) assessment period* with *Future (2016-17) assessment period*]

Question #11: Do your operators know how to read your salt application rate charts?

Current: No, supervisors read the charts and assign rates

Predicted: Yes

Question #13: What guidance do you give to your crew for hand spreading?

Current: Have a hand spreader in bucket of salt instead of scoop

Predicted: Amount of deicer is calculated each time based on square footage and pavement temperature

Question #28: How do you select your application rate?

Current: MDSS in charge: MDSS information is for general conditions not specific to operators route: operator follows MDSS advice

Predicted: MDSS in charge: MDSS information is from information in each truck sensors, conditions specific to operators route" operator follows MDSS advice

Question #38: Do you have any automated anti-icing systems built into your pavement surfaces?

Current: No

Predicted: Yes

Current (2012-13) Poor Practices

Question #	Question	Response
1	How often do you calibrate spreaders?	Most equipment every other year
3	How many liquid pre-wet systems do you calibrate? (Pre-wet refers to a system that discharges liquids onto granular products)	Less than half
8	What % of your fleet is set up for liquids (of the trucks that apply salt)?	0-49%
12	What materials do you calibrate for?	Don't calibrate
19	For parking lots / sidewalks, what is your most common anti-icing rate for straight magnesium or calcium chloride liquid?	More than 0.4 gallons per 1000 sq. ft (18 gal. per acre)
26	Are your application rates based on pavement temperatures?	Don't have application rate charts
31	How is the blast button set?	1000 lbs
36	How do you treat frost?	Apply granular salt after frost is formed
40	What is the first step you take with slush that will refreeze?	Salt it
41	For roads, what do you do with a light snow (< 1" total for event)?	Without plowing, salt or sand it if needed
43	For parking lots, what do you do with a light snow (< 1" total for event)?	Without plowing, salt or sand it if needed
44	Do you use weather prediction systems better than the TV news?	No
48	How do you salt when plowing in tandem?	Most plow trucks salt; nothing done to prevent loss of salt from plowing.
59	Do you have the ability to plow continuously throughout the storm?	Snow removal is only at end of storm
60	Is your response to snow events the same during weekdays hours and weekend/evening hours?	No
62	Do you use a sand/salt mix as your primary deicer?	Yes
68	Do you understand the practical pavement temperature range of your deicers?	No
69	We select the appropriate material for the pavement temperature:	Don't adjust our product selection based on pavement temperatures
70	When pavement temps are below 15 degrees how often do you use dry rock salt?	All of the time

Next Steps



Chloride Management Plan Timeline



- Draft TCMA chloride management plan & TMDL under MPCA review
- Expect public review - *spring 2015*
- Approved plan & TMDL - *summer 2015*
- Develop Winter Maintenance Assessment tool & test - *early 2015*
- Implementation of plan already underway!!



Questions

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